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Atomic Energy Legislation:

THE ATOMIC SCIENTISTS BACK THE McMAHON BILL

The Federation of Atomic Scientists was invited to testify before the Senate's Special Committee on Atomic Energy on the subject of atomic energy legislation, particularly, the McMahon Bill, S-1717. Dr. Harrison Davies, of the Clinton Laboratories at Oak Ridge, the representative of the Federation, was heard on Jan. 28. His testimony, the result of the joint efforts of the site groups, follows:

I am here this morning to present the views of the Federation of Atomic Scientists, composed of scientists and engineers who have worked on the Manhattan Project. For several months we have studied the various proposals for domestic legislation on atomic energy. As scientists we desire legislation which will foster research and development in the field of atomic energy and will preserve the freedom necessary for the further advance of science. As citizens we fear unwise laws on atomic energy for the same reason other citizens fear them: we too value our lives.

Long before the atomic bomb fell on Hiroshima we realized that it would affect political and economic ideas all over the world. While the rest of the world was preoccupied with war, we came to the view that our work might well have more far-reaching results than the winning of the war itself.

While we debated the issues and strove for a plan which might secure safety for the world and yet realize the full benefits of atomic energy, we lacked advice from other quarters. With the release of the bomb and the introduction of atomic energy legislation into the Congress, it became possible to form organizations, seek expert opinion in other fields, and publicize our views. We have done our best to add to our technical knowledge of atomic energy some understanding of the complex political, legal and economic features of the problem.

The Federation of Atomic Scientists has developed a set of policies which our members believe should be embodied in atomic energy legislation. We now have the opportunity to compare our aims with the provisions of a specific bill. The McMahon Bill satisfies these aims in great detail. The men who made the bomb are for the bill. I wish to report to the Committee that S-1717 has the strong support not only of more than fifteen hundred Manhattan Project scientists and engineers, but of thousands of other scientists.

I appear here today empowered by the groups which make up the Federation of Atomic scientists to tell you why we like the McMahon Bill; why we think that with a few minor changes designed to strengthen the obvious intent of the bill, it will be the best practical solution of the problems of domestic legislation.

Any bill should include two aims: security for the country and exploitation of the peaceful benefits of atomic energy. With these in mind, we have examined S-1717 in terms of: (1) contribution to the hope of peace; (2) stimulation of research and development; (3) provisions for studies and reports by the commission; (4) administrative structure.

INTERNATIONAL CONTROL AND THE NATIONAL SECURITY

There can be no real national security in a world in which many nations possess atomic weapons. There can be no solution of the problem of security short of an effective international control of atomic and other weapons of offense, and of the elimination of war as a method of settling international disputes. Any domestic legislation must, therefore, encourage the international control of atomic energy. We believe that S-1717 fulfills this requirement. The problem of the production of atomic bombs is treated specifically; responsibility is so fixed that international regulation must take precedence. In this respect, we feel that the addition of a general section stating explicitly that international agreements will supplant the

(Continued on Pages 4 and 5)

Control Problems:

3. Control of a Gaseous Diffusion Plant

This article, the third of a series, is a condensation of an analysis by Dr. M. Benedict of the Kellex Corporation. The previous articles dealt with a general survey of the control problem and with the control of uranium mining.

The gaseous diffusion process is one of the most practicable means for the production of an explosive for atomic bombs. Any system of international control of atomic energy must contain provision for the inspection of the world for evidence of unauthorized construction of diffusion plants and for the inspection of operating plants to prevent the diversion of U-235 into unauthorized uses, such as bombs.

There are three principal questions which should be investigated:

First: Can a system of worldwide inspection be devised which will insure that no gaseous diffusion plant will be constructed without the knowledge of the international control authorities? It is believed that an effective system can be devised, provided a sufficiently elaborate arrangement of overlapping inspections is instituted.

The second question is a related one: Can a system of world-wide inspection be devised which will insure that a diffusion plant is not operated without the knowledge of an international control authority? The point here is that plants may be built before the inspection system is devised. It is thought such plants could be made very difficult to detect.

The third question: Assuming that the location of all operating plants is known, can a system of inspection be devised which will prevent a significant amount of uranium 235, in a gaseous diffusion plant, from being diverted to uses not authorized by international control agencies? It is felt that the probability of such diversion is small and the amount of material potentially divertible can be reduced, but that neither of these can be made negligible in an operating plant.

The assumptions which have been made in arriving at these opinions are: first, inspectors will have free access to

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CONTROL OF A GASEOUS DIFFUSION PLANT Cont'd

all parts of the world and all industrial establishments which they must visit in the pursuit of their duties. That does not mean there will be an inspector on every block, but that if a man has to have certain information on a particular plant he will be allowed to enter and inspect all parts of it. Secondly, all nations will be aware that inspection is carried out: It won't be done as an OSS job, but through accredited inspectors.

Detection of Plant Construction

There are three principal types of activity which would be used as evidence that diffusion plant was under construction, (1) research and development in connection with the process, (2) manufacture of equipment for the process, and (3) construction of the plant proper.

(1) Research and development work would have to be done on diffusion barriers, on centrifugal blowers and on other types of equipment. If inspectors were periodically to visit research establishments it would not be difficult for them to determine that work of this character was being done. However, there is no way of establishing that all the research institutes of a country were visited. Thus, inspection of research establishments, while it might make construction of the diffusion plant more difficult, would not of itself insure detection.

(2) There are a few key pieces of equipment which have be manufactured in tremendous volume for a diffusion plant. The principal ones appear to be diffusion barriers, centrifugal blowers, valves, bellows, and pneumatic instruments.

Centrifugal blowers appear to be most readily amenable to inspection, though diffusion barriers are the most distinctive features of a diffusion plant. There are so many different types of material which could be used for barriers, and it would be possible for another country to manufacture them in so many different ways, that one would not know where to station inspectors nor what to look for. Valves, metal bellows, instruments, are all articles of commerce and an inspection system to check on items of this character would really be a very difficult and possibly a fruitless undertaking.

(3) The tremendous size of the diffusion plant appears to be the most likely means for insuring the detection of its construction. The principal features of construction of a diffusion plant, like any other large engineering undertaking are: preparation of the site, erection of buildings, accumulation of materials of construction, procurement of the power supply, assembly of large numbers of construction workers, and assembly of a significant number of engineers, scientists and other technicians. The construction of the diffusion plant above ground will involve the movement of large quantities of dirt, which constitutes an obvious change in the surroundings.

An enormous building, or a large number of smaller buildings, would be required to house a diffusion plant. A large amount of freight would have to converge on the point or points at which the plant was being erected. Some 33,000 carloads of freight were shipped to one point in connection with the construction of our Diffusion Plant. At the peak of construction, 25,000 workers were employed. A staff of over 1,000 engineers was assembled. All of this would be evidence of large scale activities which warranted further investigation by the inspectors.

The construction of the American Plant took about two years and during at least a year of that time there was obvious evidence of large scale construction activities.

For these reasons, it is believed the following inspection procedures would insure the detection of construction of diffusion plants: Firstly, periodic aerial surveys should be made at one year intervals of the entire land surface of the earth; secondly, resident inspectors would have to be stationed in all cities large enough to house a diffusion plant with the probability of its not being observed from the air; and thirdly, it would be necessary to inspect, at intervals of one year, mines and other underground enclosures large enough to house a plant.

An additional possible check is the observation of the commerce of a country, in order to know what types of freight are being shipped to what areas, to assist the geographic search for the construction of a plant.

While it is probable that each one of the inspection methods suggested would detect the construction of a diffusion plant in most cases, it is felt that it would be necessary to use all of them to insure the detection of a plant under construction with a high degree of probability.

To be acceptable, an inspection system must not demand an excessively large inspection staff. The aerial survey of plants could be done simultaneously with the exploration of the surface of the earth for uranium mines. Additional personnel would be unecessary if one were already committed to inspect the earth for new mines. Similarly, plant inspection in large cities, could be incorporated with other inspection activities, and therefore might not require a large number of additional personnel. Nor will the centrifugal blower inspection require a large number of people. There are probably now no more than 30 or 40 plants in the world which could do the job in the volume required. The one type of inspection which would call for many people is the check of the freight traffic of the world. It would probably be opposed by practically every country, on a number of grounds.

Control of Plant Operation

When the inspection system is set up, can one account for everything going on in the plant? The view on this is somewhat pessimistic. It would be very difficult to determine exactly how much uranium 235 is being produced per day and what was being done with it. The diffusion plant is an extremely complicated and extensive asssemblage of all kinds of equipment. Over 600 miles of piping of assorted sizes are in the American Diffusion Plant, and it holds nearly a million cubic feet of a gaseous uranium compound. Contrast with this the volume of Uranium 235 produced per day which is only a fraction of a cubic foot.

Because of the tremendous size of the plant an appreciable fraction of the plant's production disappears each day through legitimate losses. Thus, no matter how carefully one measured the amount of 235 charged to the plant, one could never hope to account for all of it in the product and waste shipped from the plant. Some will disappear in the process even in an honorably run plant. The initial efficiency of recovery in the plant may be improved during operation, and the material recovered through increased efficiency may be diverted to improper uses.

In the American Plant, one guess is that from one to five bombs per year could be produced from non-accountable material if one sought to divert material improperly.

The principal conclusion is: if we wish to be sure that no uranium 235 is being diverted from uranium isotope separation plants, we had better not build such plants in the first place.

If this is so a well-planned evasion of any inspection system of operating plants could succeed at least to a certain extent.

There are some who are more optimistic and contend that simple changes in operation could greatly reduce the danger of diversion.

COMMITTEES:

Publicity and Contacts
(Chairman—K. Way)

Meetings Mondays, 4:30 P.M., Room 208 in Jones Chemistry Bldg.
Speakers Bureau .....A. S. Langsdorf
Radio and Newspapers .....R. Adams
Magazines .....K. Way
Organizations .....H. Hyman

Materials
(Chairman—L. I. Katzin)

Meetings Fridays, 5 P.M. in Room 208 in Jones Chemistry Bldg.
Legis. Research .....F. L. Friedman
Records .....R. L. Platzman

CONGRESSIONAL NEWS . . .

SENATE HEARINGS ON ATOMIC ENERGY

The Senate Committee on Atomic Energy resumed its hearings on Jan. 22. It is expected to hear witnesses on domestic legislation for a period of three weeks. Below we continue our brief reports of the testimony.

Jan. 22, Harold D. Smith, Director, Bureau of the Budget: Mr. Smith's testimony was limited to a consideration of the feasibility of the structure of the proposed Atomic Energy Commission as set up in the McMahon bill. While approving of the bill in general and of its exclusion of the military in particular, Mr. Smith criticized several administrative features of the bill. He felt that (1) the internal divisions of the Commission should not be set up by statute at this time, but left to the discretion of the Commission, (2) the Commission should be provided with a single administrative officer in order to promote efficient administration, (3) the Division heads should be appointed by the Commission rather than by the President to avoid division of responsibility, (4) the size of the Commission should be cut from five to three members, and, (5) the Commission should not be given the powers to create corporations.

Mr. Smith thought the members of the commission should be "broad gauge" men and not specialists in one field (as scientists or military men.) Senator Hickenlooper suggested that the Commission should be representative, i. e. include scientists, and certainly a military man, at least for the duration of the present emergency period.

William H. Davis, former Economic Stabilizer: Mr. Davis strongly objected to the mandatory provisions for the compulsory licensing of patents in the atomic energy field. He agreed that the Commission must have the power to enforce compulsory licensing where it deems such action in the public interest, but feels that such action should be at the discretion of the Commission.

Davis stated that he would like to see the army announce what the energy stored in its present stock of atomic bombs could accomplish for the good of mankind if the material in them were used for peaceful purposes. Senator Hickenlooper countered this with the opinion that it would do a lot of good in the international situation if the army would announce that we had enough bombs to blow any other country off the face of the earth.

Jan. 23, Harold L. Ickes, Secretary of the Interior:

"The McMahon bill, S. 1717, is carefully designed to safeguard the progress and the freedom of science while maintaining the integrity and supremacy of civilian government. These objectives of S. 1717 are close to my heart. I am entirely in accord with their major implications.

I agree that our national safety and our industrial progress depend upon our doing the biggest job of scientific research that has ever been done in the world; that we cannot leave that research to private initiative and industry; that the Federal Government, with all of the aid that it can get from the colleges and private laboratories, must shoulder the main burden of that task, while leaving free the road of private scientific research; that the Government must be empowered to maintain full access to all private scientific developments in this field, to own all patents and materials, and to control all military and industrial applications of atomic energy in such a way as to protect the public safety; that at the same time the Government must give increased attention to the social and economic possibilities, as well as to the physical and medical implications of atomic fission; that any control agency set up in this field should be responsible to the President of the United States and not to an irresponsible super-government; and that whatever is done by such a control agency must be open to the broadest scrutiny and congressional supervision based upon the regular and detailed reporting of agency activities. A democracy cannot afford to keep secrets from itself.

The underlying theme of S. 1717 is that scientific progress and scientific freedom are indivisible; we cannot advance the cause of science and civilization by making research a crime. This cannot be said of some other bills which have been introduced in this field.

I think that the distinction is wisely drawn in S. 1717 between the realm of discussion and experimentation, where freedom is the only safe rule, and the realm of applied technology, where, in a matter that involves the national safety and welfare so vitally, social control is essential. The control that S. 1717 would impose upon the commercial production of fissionable materials and their utilization in industrial channels seems to me to be entirely justified. If the push of a button can destroy a city, no nation can afford to leave the button in private hands. That would amount to an abdication of sovereignty.

This bill is designed to maintain the integrity and supremacy of civilian government. That seems to me to be a matter of very great importance.

We have only a little time in which to negotiate with other nations for a security which cannot be achieved by a monopoly of knowledge or by specific military defenses, a security which must be based upon the international sharing of knowledge and adequate international inspection and policing. That kind of agreement can better be achieved if the control of atomic energy is in civilian rather than military hands. I do not blame the military for suspecting and preparing for the worst from all other nations. That is its job. But you cannot successfully negotiate an international agreement unless you start with the assumption that it will be advantageous to all the parties concerned.

If you look at this problem of atomic energy only through military binoculars all that you can see is the threat of future wreckage, to which the only answer is more wreckage. Even the destruction of enemy cities at the outbreak of a war would not provide an adequate defense. Presumably enemy storage and transmitting areas may be located in uninhabited sections of desert relatively immune from attack. If we want security for our homes and our children—not just the uncertain satisfaction of hoping that in an atomic war we might kill sooner more of the enemy than they could of us, we are going to have to gain that security by working out arrangements of mutual advantage with other nations. Nor will that job be facilitated if we make atomic energy control a function of the military.

We need to have civilian control of atomic energy in the interest of the development of our Nation and of industrial and medical progress, as well as in the cause of world peace and true national security.

If I am correct in believing that commercial use of fissionable materials is not an immediate possibility, I think that there might be some advantage in leaving for future congressional consideration the terms that should govern the disposition of fissionable materials. After all, we can't solve at once all of the problems that atomic fission puts before us. Whatever legislation is enacted this year must be considered interim legislation, to be amended when our knowledge of the subject is greater than it is today. This matter of the disposition of the sources of atomic energy might very well be left for some other time when we are better informed than we are today of the economic ramifications of the problem. True, that would leave our legislation incomplete. But completeness may be a false goal in interim legislation."

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provisions of the bill will enhance the prospects for obtaining effective agreements. Furthermore, the provisions of the bill for the domestic development of atomic energy are such that international control can be introduced without serious domestic dislocation. A commission, responsible to the President and to the Congress, controls the production and the distribution of fissionable materials; the commission has full powers of inspection and can require reports on all work in the field; private monopolies are not permitted; premature industrial development which might prejudice international agreements, by the creation of vested interests and by complicating the inspection problem, are not allowed.

STIMULATION OF RESEARCH AND DEVELOPMENT

Vigorous research and development in nuclear science must be maintained. The use of the fission phenomenon and its by-products in physical, chemical, biological, medical and industrial research, as well as in power development, should greatly enrich our country and indeed all mankind.

Bill S-1717 will foster such research and development through equitable distribution of fissionable material and of by-product materials to all research workers, by granting funds to independent research organizations — such as universities, private and industrial laboratories — through the widest possible dissemination of information, and by creating a division of governmental research to insure a complete program.

The provisions of the bill for allocation of fissionable and by-product materials are the best guarantee for rapid development in the field of atomic energy. No requirement other than the capacity to satisfy health and safety standards is set forth. We consider this requirement sufficient.

Independent research is encouraged by the bill. Government research is not preferred above private research in the allocation of funds. We regard this as a highly desirable feature of legislation in the atomic energy field or for that matter, in any other scientific field. The full development of science rests upon independent research by many individuals in many laboratories throughout the world. The direction which scientific research will take at any time cannot be predicted nor can research be completely guided by even the most intelligent administrator or scientist. Ideas come from the most unexpected sources. Scientists in a well-staffed, well-equipped laboratory may work on a problem for many years and yet those new and revolutionary ideas which may completely change the complexion of their work can come from a single scientist or from a small group working in a poorly-equipped laboratory in a small country. It is, therefore, of the utmost importance that problems be studied by many independent groups and individuals. All competent scientists should be allowed to study the problems of atomic energy and to obtain the materials and such funds as are necessary for their work.

The Bill provides for the wide distribution of by-products, such as the radioactive products. The use of these materials as tracers or "tagged atoms" in the study of biological, chemical, medical and industrial processes will, we believe, lead to the first peacetime applications of fission. Study of the by-products themselves will advance our knowledge of the fundamental properties of matter.

The dissemination of basic scientific information and, when possible, related technical information, is made mandatory. The bill, in fact, attempts to provide the freest possible exchange of scientific information. We strongly approve of such provisions, and feel they should not be abridged. Science cannot prosper in secrecy. Science cannot develop when workers in a particular field may not discuss problems with those in similar fields. The wide publication given to fundamental scientific discoveries in the last forty years is largely responsible for rapid scientific development. The fact that S-1717 encourages this point of view is applauded by the atomic scientists. For similar reasons we would like to see the force of the patent section maintained in guaranteeing freedom for use in this field of all discoveries and inventions.

We approve the security regulations of the bill. During the war most scientists not in the armed forces worked on secret war projects. Secrecy regulations were based on the Espionage Act and successfully denied important information to the enemy. We feel the Espionage Act will provide as much national security as can be found in a policy of secrecy. We are pleased that the McMahon Bill bases its security regulations upon this Act and does not set up any further power to make arbitrary secrecy regulations.

STUDIES AND REPORTS BY THE COMMISSION

The American people have a large interest in the development of atomic energy. Progress and policy in this field should be subject to public scrutiny. The bill provides that the commission shall submit quarterly reports to the President and to the Congress. These reports must detail the activities of the Commission and

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The first Council meeting of the Federation of American Scientists (FAmS) is reported on the last page of this issue. The success of this organization will determine to a large extent whether American scientists will be able to exercise their full influence in shaping the national and international policies in the "atomic age."

The FAmS grew from a nucleus formed by the Federation of Atomic Scientists (FAtS) — a central organization of the five associations, formed by scientists at the various "sites" of the Atomic Bomb Project.

The desire for immediate extension of the FAtS to include scientists outside the Atomic Bomb Project came from two sources. In the first place, many Project scientists, particularly at Los Alamas, were leaving the Project, and felt that they could best continue their work by organizing new groups of scientists in the colleges to which they were going, and bringing them into the Federation. In the second place, a desire to collaborate equally with the "atomic scientists" arose spontaneously in several non-project groups of scientists.

Because of the desire of these groups for integration, the formation of the FAmS came at a time when some Atomic Bomb Project groups — notably those at Chicago and Clinton — were not quite satisfied that the FAtS had already achieved all that they could achieve, or that they should be immediately absorbed by the larger organization. While the desirability of an organization open to all American scientists who want to work for enlightment of the public on the implications of atomic power was r e c o g n i z e d at these sites, two points appeared to be in need of clarification, which only time could bring.

First, from a purely tactical point of view, a certain — even if largely undeserved — prestige was and is still attached to the group of scientists who have actively participated in the creation of the atomic bomb.

Secondly, the work on the Atomic Bomb Project has put an indelible stamp on the minds of practically all scientists who took part in this work. Independently of their political affiliations, they all were and still are overwhelmed by the realization of what an atomic war will mean to this country and to the world. They are, therefore, ready to subordinate all other tasks which an organization of scientists may undertake, to a single aim — that of ensuring an international control of atomic weapons and making wars impossible thru the proper organization of the world.

It remains to be seen whether a similar unity and uniqueness of purpose

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can be achieved in a nation-wide organization, open to all scientists—not only in an initial resolution, but also in practical, everyday work. With this in mind, the Atomic Scientists of Chicago, as well as several other Atomic Bomb Project groups, while joining the Federation of American Scientists, prefer that the Federation of Atomic Scientists be maintained as a separate entity, working in close and friendly cooperation with the newer group.

In the past, American scientists have been represented by two kinds of organizations—the academies and professional organizations such as the National Academy, The American Chemical Society, or The American Physical Society, and organizations of "socially conscious" scientists, such as the American Association of Scientific Workers. The professional organizations are "non-political." In practice, some of them consider the defense of the professional status of their members sufficient reason for taking a definite stand on many political issues.

The great problem before the FAmS is to avoid leaning in either of these two directions. The Federation must not engage in a fight for the professional standards of scientists, nor become tinted with a definite political color. The Atomic Scientists organizations have succeeded, in the short period of their existence, in impressing large sections of congressional and public opinion by their complete devotion to the one task at hand—prevention of atomic war — and their independance of any professional or partisan political motives.

This was not easy, particularly in the case of the fight against the May-Johnson Bill, which could easily be—and actually was—interpreted by some observers as motivated by the scientists' concern for their traditional free and secluded "way of life." The attitude of the FAtS on the question of the "atomic bomb secret" also lent itself to misinterpretation in terms of political partisanship.

The ASC, in joining the FAmS, does this in the hope that this organization will steer the same straight course, by concentrating on what we think is the main problem of our time, and in conducting its fight for the solution of this problem in such a way as to avoid all appearance of political partisanship. The greatest disaster for our cause would be to allow it to become a subject of division between "left" and "right". The dividing time must be between intelligence and short-sightedness, between understanding and lack of imagination; our aim is—and must remain—to enlighten all, not to rally a sympathetic faction.

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must include the commission's program for the following quarter. Thus the work of the commission is constantly in the public view and a means is provided for insuring that the commission will act in the public interest. The atomic scientists look to the continuing interest of Congress to insure the development of atomic energy for the maximum public benefit.

Further, the bill provides for studies of the social, political and economic implications of atomic energy and that these studies shall be reported as a basis for new legislation, particularly with regard to future industrial uses. New developments in atomic energy will be studied from the point of view of their effect on our national economy and a sound basis will be provided for future developments. In addition, international agreements will be facilitated since premature or uninformed legislation on such questions as the future large-scale use of atomic energy will be avoided.

Bill S-1717 encourages research and development in the field of industrial application of atomic energy. The policy of postponing large-scale industrial applications is, in our opinion, a wise policy. Industrial processes should certainly be developed, and the bill provides adequately for their development. Widespread industrial application, on the other hand, may present us with new difficulties. The economics of atomic power development are too uncertain to permit a decision at this time. Furthermore, premature development of special interests in this field may prejudice the possibility of international control. The possession by individuals or private groups of the facilities for producing fissionable material — the production of power may be accompanied by the production of fissionable materials — would greatly complicate the problems of international inspection and control.

It is worth emphasizing once again that strong government control, based upon a government monopoly of the production of fissionable materials, protects us from the misuse of these materials and prepares us for the possibility of an effective international control system.

ADMINISTRATIVE STRUCTURE

The composition of the commission has been discussed by the Committee. Two hostile viewpoints have been presented. The commission, it is said, should be small for the sake of efficiency. On the other hand, the commission should be large in order to permit representation of the many groups whose affairs touch upon the commission's activities. We believe that the commission members should have but one interest, the public welfare. A need for further coordination among government agencies and the Commission can perhaps be achieved through the presence of representatives of such agencies at the commission's deliberations. In our judgment the number of commissioners should not be decreased. It is essential that their appointment be full-time.

We wish to go on record most strongly as favoring complete exclusion of the military from any policy-making function on the commission. By this we do not mean to exclude efficient liaison between the commission and the armed forces. Provisions making this liaison mandatory as suggested by Secretary Forrestal would not be opposed by the Atomic Scientists. However, it is in the best tradition of American government that policy be made by civilians. A subject fraught with such tremendous significance to our foreign policy as the development of atomic energy in this country must certainly be freed from every vestige of military control.

The administrative structure of S-1717 seems very satisfactory. Some of the functions of a future commission have now been recognized and the bill provides for them. Thus, Divisions for production, allocation, research, and military application are established and their directors charged with the day-to-day supervision of these activities. This arrangement should leave commissioners free to formulate policy.

The system of Presidential appointment and removal eliminates the possibility of insulation against review and against change. The policy-making function of the commission, together with the delegation of administrative duties to the Divisions, makes real the functions of the appeal boards provided for by the bill. Were the commissioners also the administrative officers, we feel appeals would have little meaning, since they would be directed against those people who had already formulated the policies and made the decisions.

There are a number of minor changes, designed to clarify the bill's intent that we could suggest. We should be glad to submit those to this Committee, if it so desires. We have not brought them forward in this testimony, since we do not wish to divert attention from the important points. The major questions we have discussed and the treatment by the bill of these questions leads us to regard S-1717 as a very good bill. The atomic bomb project scientists strongly urge its rapid enactment into law.

5.

THE DISTRIBUTION OF URANIUM IN NATURE

Ordinary uranium is the basic raw material for the production of atomic energy. The only known sources of atomic energy which are of practical significance are the fissionable isotopes, uranium 235 and plutonium 239, both of which are obtained by the processing of ordinary uranium. Since, according to competent authority, this situation will very likely persist for some time to come, an evaluation of the world resources of uranium is of paramount importance to an understanding of the future role of atomic energy. There are two aspects to the problem. The first is the total amount of uranium available, the second deals with accessibility.

Uranium is of very wide distribution in nature. The radioactivity of uranium affords a very sensitive test for its presence; consequently innumerable specimens of rock, water, and vegetation have been analyzed for their uranium content. So extensive is the available data accumulated in the last fifty years, that it is possible to answer the question of how much uranium is present in the world with a reasonable degree of certainty. About 95% by weight of the earth's crust consists of the igneous rocks, granite and basalt. The average uranium content of these rocks is 0.004%, or about one-seventh of an ounce of uranium per ton of rock. Granite rock, such as constitute the Appalachian Mountains, contains a rather higher proportion of uranium than does basalt; in granite there may be as much as one ounce of uranium per ton of rock. The earth's crust is so heavy that even these very small percentages represent a huge total uranium content. The weight of uranium near the earth's surface has been estimated to be 10^{15} (1 followed by 15 zeros) tons. The oceans also contain minute amounts of uranium, with a total uranium content of about ten billion tons. It is interesting to compare the uranium content to other more familiar elements. There is more uranium present in the earth's crust than cadmium, bismuth, silver, mercury, or iodine. Uranium is about one thousand times as prevalent as gold.

While uranium is thus seen to be omnipresent in the rocky portions of the earth's crust, the number of places where uranium occurs in concentrated form is relatively small. Even so, uranium in quantities large enough to be visible to the naked eye has been found on every continent and almost in every country. About one hundred uranium containing minerals have been identified. These occur in quantities ranging from a few isolated crystals to ore deposits estimated to contain thousands of tons of uranium. Of the latter, only four deposits were know before the war. Small occurrences have been found in Europe in Sweden, Norway, Germany, Czechoslovakia, France, Belgium, Portugal, Italy, and European Russia. All of these except the Czechoslovakian (St. Joachimsthal) deposits are, as far as is known, either very small, or of very low uranium concentration. In Africa, uranium minerals have been found in Cape Provinces, at Morogoro on the East Coast, and of course, in the Belgian Congo, where the world's reputedly richest deposits exist. Uranium also occurs on Madagascar in amounts which were once considered great enough to warrant commercial explotation. In the Western Hemisphere, large deposits are know to occur in Utah and Colorado in the United States, and in the North Territories of Canada. In addition there are scores of small occurrences in Ontario and Quebec, and in various parts of the United States (North Carolina, Connecticut, Texas, North Dakota). Uranium has also been found in Mexico and Brazil. Fairly extensive deposits are known to exist in Russian Turkestan and India, and small amounts are present in Australia, New Zealand, and Japan. The actual magnitude of the so-called small deposits is a difficult matter to establish. It is not unlikely that further exploration near the regions known to contain uranium may reveal much larger quantities than had previously been suspected.

Hitherto, the decision to commercially exploit a given uranium deposit was dependent entirely on the costs of producing radium from it. The uranium was strictly a by-product. On this basis, only the Belgian Congo and the Great Bear Lake deposits in Canada have been able to compete in the world market. The deposits at Joachimsthal and in Colorado were unable to do so.

Now, of course, this situation has changed completely. The use of uranium for the production of atomic bombs and for the potential production of power has shifted the interest from radium to uranium. Furthermore, the use of uranium piles will completely eliminate the demand for radium.

From a broad point of view, as much uranium can be obtained as organized society finds worth while. Ores are commonly mined which contain only one-fifth of an ounce of gold per ton of rock. Now, vast quantities of rock exist which contain from one-fifth to one ounce of uranium per ton of rock. If society decides uranium to be as valuable as gold, then practically unlimited quantities of uranium are available for use in supplying atomic energy. For instance the carnotite ores of Colorado can be made to yield large amounts of uranium.

While uranium at the price of gold may not be able to compete economically with common sources of energy, there is little question that as far as atomic bombs are concerned, monetary considerations are not pertinent. In the event of an atomic armament race, survival demands uranium, and every country will strain its resources, if necessary, to attain a sufficient supply. Insofar as controls and inspection are concerned, it appears that any country can secure as much uranium as would be necessary for atomic warfare. The problem is whether a country could secure large amounts of uranium without a good probability of detection. This question can best be considered in the light of what is known about uranium deposits.

There are at present four regions in the world where uranium occurs in such quantities that ordinary mining operations suffice to yield considerable amounts of uranium. These are the pitchblende deposits of Canada and the Belgian Congo, the relatively less important carnotite sandstones of Utah and Colorado, and the minor pitchblende deposit at Joachimsthal. In two regions, (Canada and Africa), there is enough uranium to make if possible to obtain one ton of uranium from fifty to one hundred tons of ore. In the other two cases perhaps five times as much crude ore must to be mined per ton of uranium. As far as is known, these four deposits are geologically unique. Each one differs from the others, and it is not unlikely that they represent really rare geological phenomena. Even intensive exploration, based on previous experience, will probably not reveal more than a small number of similar occurrences. Their number is at present so small as to render surveillance a rather easy matter.

The situation would be radically different if an attempt was made to use granite as a source of uranium. In order to obtain one ton of uranium, it would be necessary to quarry somewhere between 40,000 and 250,000 tons of rocks. While this is technically feasible, it is an enterprise of such a magnitude as to render concealment impossible. The operations would require a great deal of heavy machinery, large numbers of workers, immense amounts of explosives and chemicals. Extensive transportation facilities and, in general, huge plants would be essential. These could scarcely be hidden.

It thus appears that inspection of uranium mining operation may provide at least a fairly satisfactory mode of control. However there is the possibility of the discovery of very rich deposits, with the resultant ability to obtain large amounts of uranium in an unobtrusive fashion. The only sure way of eliminating this possibility would be an intensive prospecting campaign of those areas of the earth which have as yet received little attention.

INTERNATIONAL NEWS . . .

UNO CREATES ATOMIC ENERGY COMMISSION

The UNO Assembly, at its first meeting on Jan. 13, referred the Moscow resolution on the atomic energy commission to its Security and Political Committee. The Committee recomended the adoption of the resolution without changes. On Jan. 24, the Assembly voted 47 to 0 to set up the 12-nation commission.

We present the following report of addresses given during the first two weeks of the UNO meeting.

Prime Minister Atlee: "We on these islands, which were for so long immune from attack behind the barrier of the sea, feel perhaps more than any others that we are living in a new age. The development of powerful weapons of destruction operating from distant bases has destroyed the illusion of isolationism. The coming of the atomic bomb was only the last of a series of warnings to mankind that unless the powers of destruction could be controlled immense ruin and almost annihilation would be the lot of the most civilised portions of mankind.

I welcome, therefore, the decision to remit the whole problem of the control of atomic energy to a commission of the United Nations Organizations. In this discovery we can see set clearly before us in tangible form the question that faces the modern world. Here is an invention fraught with immense possibilities, on the one hand of danger and, on the other, of advantage to the human race. It is for the people of the world through their representatives to make their choice between life or death."

Jan Masaryk, Czechoslovak Foreign Minister: "The armaments industry, together with the latest devastating inventions—physical, chemical, biological, psychological or sociological—should be put under the control of the United Nations." He expressed the hope that "not one particle of uranium produced in Czechoslovakia would ever be used for wholesale destruction and annihilation."

"We want our uranium," he declared, "to do exactly the opposite—to build, to safeguard, to raise the standard of living, to make our lives more secure and efficient. To this we wish to dedicate our uranium mines. Please help us."

Asked if "the output from mines should be open to international inspection?" he replied, "yes, I hope so."

Sec'y of State Byrnes: "The report calls upon us to join in creating a commission to study, from the point of view of international control, the problems created by the discovery of atomic energy and of other forces capable of mass destruction.

"It calls upon us to find ways which will permit and promote the use of our knowledge of the forces of nature for the benefit of mankind under safeguards which will prevent their use for destructive purposes.

"In meeting these problems we must realize that, in this atomic age and in this interdependent world, our common interests in preserving the peace far outweighs any possible conflict in interest that might divide us.

"I hope that the General Assembly will promptly approve the resolution which is before it. I hope that the commission will promptly set to work on its tasks. It will be comforting to the peace loving peoples of the world to know that we are moving promptly to endeavor to find ways to avoid a race in armaments."

Senator Connally: "In performing its work the commission must obviously operate within the framework of the powers conferred on the UNO by its Charter.

It is authorized to make recommendation but not to compel action on the part of any States. Each State will be free to consider the acceptance or rejection of the commission recommendation in accordance with its own constitutional processes."

Mr. Peter Fraser, Prime Minister of New Zealand: "We are not completely satisfied that the procedure suggested in the resolution is the best possible. While the problem of atomic energy has important security aspects, it has other aspects also related to the opportunities which it offers for the benefit of mankind.

"We think that a better account would be taken of this many-sided nature of the problem if the commission were to work under the direction of the general assembly.

"This seems to us to be particularly important at the present exploratory stage when the first task, even before making any recommendation, will be to define the many complex issues involved in this vast problem."

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without asking whether this control can be achieved by international agreement or only by world government.

It was pointed out that if the public is made fully aware of the importance of preventing atomic war and if it finds that the UNO is unable to provide this security, it may then turn to World Government as the only satisfactory solution. Therefore, insistence on the dangers of an atomic war and the necessity of international controls may be more effective than direct appeals for World Government.

EMERY REVES ON WORLD GOVERNMENT

On January 17 and 18, two meetings devoted to a lecture and discussion on the subject of World Federation were jointly sponsored by the ASC and the U. of C. Office of Enquiry. The speaker was Emery Reves, author of "Anatomy of Peace." The meetings were made possible by Mr. Hamilton Holt, President of Rollins College. Mr. George Holt presided.

Mr. Reves presented the thesis that no agreement between sovereign nations can solve the problem of war, and consequently, international control of atomic energy is useless—and perhaps impossible—as long as severeignity is not transferred from individual nations to a world federation. He suggested that working for immediate creation of such a federation is at least as important as an attempt to achieve UNO control of atomic weapons. The functions of the world federal government may at first be restricted to security matters and interstate trade, but they must be based on overwhelming military force.

In his opinion, Britain and many smaller countries are quite ready to accept world federation. In the U. S., the attitude towards world government is more favorable than it is commonly assumed to be. Mr. Reves appealed to the atomic scientist, whose influence on public opinion he described in glowing terms, to join in an attempt to enlist newspapers, radio commentators, churches, etc. in a campaign for World Government.

If Russia or other countries cannot be persuaded to enter the Federation at once, it must be created nevertheless by the nations who are ready to accept the scheme. However there must be a clear understanding that the Federation is not directed against any nation, and it will acept any nation willing to join, at any time, without regard to the internal economic or political structure of that nation. (On this point, his view differs from that of the "Union Now" group). He stated that Russian policy is based on fear and mistrust of our intentions rather than on deliberate aggressiveness, and that we can expect Russian cooperation if we succeed in demonstrating to the USSR that we have no hostile intentions against her economic system and that we sincerely desire her cooperation.

In the lively discussion which followed the speech, several members of the ASC objected to the speaker's criticism of the UNO; others defended the ASC policy of concentrating on the technical problems of atomic energy controls.

GROUPS NOW STUDYING ATOMIC ENERGY CONTROL PROBLEMS

Within the past two months, many groups have been formed to study atomic energy control mechanisms. A listing of the most important of these groups will help clarify their relationship.

1) The UNO atomic energy commission was established on Jan. 24 by a unanimous vote of the General Assembly. This commission resulted from the preparatory T-A-K and Moscow conferences.

The commission will consist of representatives from the following 12 nations: U.S., U.S.S.R., Britain, France, China, Canada, Brazil, Australia, Poland, Egypt, Mexico and the Netherlands. It will report to the Security Council whose members are the same nations with the exception of Canada.

2) Sec'y of State Byrnes appointed a committee headed by Under-Secretary Dean Acheson to study the controls and safeguards necessary to protect this government. This committee is to instruct the American delegates to the UNO commission.

3) On Jan. 25 the State Department announced the formation of a board of consultants, to aid the Acheson committee. The board will consist of David E. Lilienthal, chairman of the TVA; Chester I. Barnard, president of the N. J. Bell Telephone Co.; J. Robert Oppenheimer, California Institute of Technology; Charles A. Thomas, vice-president of the Monsanto Chemical Co., Harry A. Winne, vice-president of the General Electric Co. Lilienthal will be chairman of the board.

4) A committee was appointed in January by Sec'y of War Patterson to facilitate the preparation of classified material for study by the Senate's Special Committee on Atomic Energy and by other authorized officials. This committee will integrate the classified material on inspection which has now been prepared under compartmentation restrictions at the various sites. It will report directly to Gen. Groves.

The members of the Committee are: Luis A. Alvarez, U. of California; Robert F. Bacher and Philip Morrison, Los Alamos; Manson Benedict, Kellex Corp.; Frank H. Spedding, Iowa State; Spofford G. English, Plutonium Project; Chauncey Starr, Electromagnetic Project; Lyman H. Bliss, Union Carbon and Carbide Co.

5) Stemming from a formal request by Sen. McMahon, the Federation of Atomic Scientists has prepared a series of reports on inspection systems. These are based on classified material and are written by teams of experts at the various atomic bomb project sites. The reports will be transmitted to the War Dep't. committee for integration.

The Federation of Atomic Scientists is also preparing a coordinated non-classified report based on the secret data. This report will be sent to the Senate Committee on Atomic Energy.

6) Another group which will study control problems in a less official capacity was formed on Jan. 5 in N.Y. at the joint conference of the Federation of Atomic Scientists and the Carnegie Endowment for International Peace. The members of the group are: James T. Shotwell, chairman; Clark Eichelberger; Edward H. Shils; Daniel Melcher; I. I. Rabi; Paul F. Kerr; R. H. Crist; John A. Simpson; Irving Kaplan.

THE FEDERATION OF AMERICAN SCIENTISTS COUNCIL ELECTS OFFICERS

On January 5 and 6, the first Council meeting of the FAmS took place at the Institute of Physics in New York. The following group attended:

Member Organizations: Rochester (66 members), B. D. Boche (official delegate), C. Stern; Chicago (200), J. A. Simpson (delegate), R. M. Adams, E. Rabinowitch; Los Alamos (350)—V. W. Weisskopf (delegate), B. T. Field, W. W. Woodward; Manhattan Project, New York (400)—I. Kaplan (delegate), F. T. Miles, C. D. Swartz; New York (City) (500), A. Nordsieck (delegate), Miss M. Philips, H. C. Wolfe; Oak Ridge (Clinton Lab.) (165)—J. H. Rush (delegate), H. Brown, H. Curtis; Pasadena (57)—R. M. Noyes (delegate), Philadelphia (310)—A. T. Fusfeld (delegate), T. S. Hauschka; Rocket Research Group (Allegheny Ballistics Lab.) (85)—J. B. Rosser (delegate). Total: 2067 members.

Organization which had not yet joined the FAmS: Cambridge scientists (about 150)—L. H. Ridenour; Dayton—C. L. Rollinson; Oak Ridge (Separation plants) (about 400)—J. A. Armitage and W. C. Beard.

W. Higinbotham was elected chairman, H. C. Wolfe, secretary of the meeting.

The following candidates received the largest number of votes for the members of the Administrative Committee: Higginbotham, Simpson, Rush, Morrison, Ridenour, Schiff, Miss Philips, Powers, Wolfe, Feld.

Originally it had been decided that the first five be members of the Administrative Committee; the next five to serve as alternates. This decision was later altered by increasing the number of members to seven, so as to include Miss Philips, as one of the three candidates (Higinbotham, Rush, Philips) who agreed to serve full time in Washington. Higinbotham was then elected chairman, Miss Philips, secretary, and Rush, treasurer.

Midwest Conference With Religious Leaders

The ASC has organized a three-day conference of religious leaders and scientists on the Problems of the Atomic Age. It will be held during the first week in February at the University of Chicago. The conference will be attended by prominent mid-west representatives of every important religious group in the country. It is to be the first in a series of conferences designed to reach the leaders in the different branches of our national life — religion, labor, farm group etc.

The principal speakers will be L. Szilard on the Physical Principles, Historical Background and Possible Future Developments of Atomic Energy; R. E. Zirkle on the Biological and Medical Hazards and Benefits of Atomic Energy and H. C. Urey on A Scientist Views the World Situation.

The chairmen of the sessions will be Profs. Warren C. Johnson and H. I. Schlesinger of the Dep't. of Chemistry, U. of Chicago. Round-table discussions will be led by Profs. Quincy Wright (International Law) and Louis Wirth (Sociology) both of the U. of Chicago.

About twenty members of the ASC will attend the round-table discussions. The chairman of the program committee is R. J. Moon.

More on

SENATE HEARINGS

James Forrestal, Sec'y of Navy: The testimony of the Secretary of the Navy was limited to the military aspects of the McMahon bill. He was concerned lest, under the provisions of the bill, the Army and Navy might lose all control over the development of atomic energy for military purposes. Forrestal admitted that there was nothing in the bill to prevent close liaison between the proposed Atomic Energy Commission and the War and Navy Departments, but pointed out that there was also nothing to require it.

He felt that the objections of the Navy would be met by amending the military section of the bill to (1) provide for mandatory liaison between the Commission, War and Navy Departments, and (2) broaden the membership of the Commission to include the Vice President and Secretaries of State, War, and the Navy, in order to facilitate such liaison. Forrestal believed that the Atomic Energy Commission should have authority over the production of fissionable materials, but that the War and Navy Departments should retain authority over the development of military applications.